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# LIQUID CRYSTAL DISPLAY DEVICE

(Ekisho hyoji sochi)

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[Title of Invention] Liquid crystal Display device

[Summary]

[Purpose] To offer a liquid crystal display device that is provided with a drive circuit so as to realize a high response speed or to provide a dual display at the intermediate tone level.

[Constitution] Memory circuit 1 for image is provided to hold at least one field image of the input image signal. The level fluctuation in the time axis direction is detected for each pixel from the input image signal and from the image signal held in this memory circuit 1. The response characteristic of the liquid crystal display device is improved by providing a time axis filter circuit 3 with a high range enhancing filter in the time axis direction of each pixel of the input image signal according to the output. In particular, the remainder image is reduced, the response speed in the intermediate tone display is increased and a high quality image is obtained.

Diagram

Input S(t)

4 - pole reversal; 5 - liquid crystal display part

[1] the numbers in the margin indicate pagination in foreign text

[Scope of Patent Claims]

[Claim 1] The liquid crystal display device is characterized as being equipped with a memory circuit for image that hold at least 1 field image of the input image signal; a level fluctuation detection circuit for detecting the level fluctuation of the time axis direction of each pixel from the aforementioned input image signal and from the image signal held in this memory circuit; a time axis filter circuit that has a high range enhancing filter in the time axis direction of each pixel of the aforementioned input image signal according to the output of this detection circuit and a liquid crystal display part where the output signal of this time axis filter circuit is supplied.

[Claim 2] The aforementioned time axis filter circuit of the liquid crystal display device of Claim 1 is a corresponding type of filter circuit where the filter characteristic is changed by the input level of each pixel of the aforementioned image signal and the output of the aforementioned level fluctuation detection circuit.

[Claim 3] The aforementioned time axis filter circuit of the liquid crystal display device of Claim 1 is

characterized as having different characteristics depending on the pole property of the level fluctuation in the time axis direction of each of the aforementioned pixel.

[Claim 4] The liquid crystal display device is characterized as being equipped with a memory circuit for image that hold at least 1 field image of the input image signal; a level fluctuation detection circuit for detecting the level fluctuation of the time axis direction of each pixel from the aforementioned input image signal and the image signal held in this memory circuit; a time axis filter circuit that has a high range enhancing filter in the time axis direction of each pixel of the aforementioned input image signal according to the output of this detection circuit; a liquid crystal display part where the output signal of this time axis filter circuit is supplied and a liquid crystal temperature detection circuit that can control the characteristic of the aforementioned time axis filter according to that detection output when the liquid crystal temperature of this liquid crystal display part is detected.

[Claim 5] The liquid crystal display device is characterized as being equipped with a memory circuit for image that hold at least 1 field image of the input image signal; a level fluctuation detection circuit for detecting

the level fluctuation of the time axis direction of each pixel from the aforementioned input image signal and the image signal held in this memory circuit; a moving detection circuit for detecting the moving part in the aforementioned input image signal; a time axis filter circuit that has a high range enhancing filter in the time axis direction of each pixel of the aforementioned input image signal according to the output of this detection circuit and according to the output of the aforementioned level fluctuation detection circuit and a liquid crystal display part where the output signal of this time axis filter circuit is supplied.

[Claim 6] The liquid crystal display device is characterized as being equipped with a memory circuit for image that hold at least 1 field image of the input image signal; a level fluctuation detection circuit for detecting the level fluctuation of the time axis direction of each pixel from the aforementioned input image signal and the image signal held in this memory circuit; a moving detection circuit for detecting the part that moves in the aforementioned input image signal; a time axis filter circuit that has a high range enhancing filter in the time axis direction of each pixel of the aforementioned input image signal according to the output of this detection

circuit and according to the output of the moving detection circuit and the aforementioned level fluctuation detection circuit; a liquid crystal display part where the output signal of this time axis filter circuit is supplied and a liquid crystal temperature detection circuit that can control the characteristic of the property of the aforementioned time axis filter according to that detection output.

[Claim 7] The aforementioned liquid crystal temperature detection circuit of the liquid crystal display device stated in Claim 4 or 6 performs the temperature detection in the aforementioned liquid crystal display part that is divided into several small images. The characteristic of the aforementioned time axis filter can be controlled by the temperature detection output of each small image.

[Claim 8] The liquid crystal display device stated in Claims 1, 4, 5 or 6 is characterized in that a complex noise removal filter is provided to remove the complex noise of the aforementioned input image signal.

[Detailed explanation of the invention] [Purpose of the invention]

[0001]

[Industrial field of use] The invention pertains to a liquid crystal display device that is provided with a drive

circuit so as to realize a high response speed or dual display at the intermediate tone level.

[0002]

[Prior Art] In general, the response speed of the liquid crystal is determined by the speed tr that goes up due to the electric field applied on the liquid crystal molecules and the speed td when they return to the original state due to the intermolecular force when the electric field becomes zero. These speeds tr and td are represented with the formula shown below.

Tr = nd2/(Delta EV - K Pi2)...(1)

Td = nd2/Kpi2.................(2)

[0003] Here, K is the elastic constant of the dispersion, the torsion, the bending of the liquid crystal, K1, K2 and K3 respectively. Therefore, the constant K = K1 + (K3 - 2K2)/4. Delta E is difference of the Es, the dielectric constant in the longitudinal direction of the liquid crystal molecule and Ep is the dielectric constant in the short axis, Thus, Es - Ep. N is the torsion viscosity of the liquid crystal. D is the thickness of the liquid crystal cell (cell gap), V is the application voltage.

[0004] It is clear from formula (1) and (2) that the response speed of the liquid crystal is increased. N and d are reduced or K is increased. Here, n and K are the

physical constants. d is determined by the minimum permeability rate and by the delta n which is the isomerism in the refractive index. The high speed response speed can be realized by changing the n, K and delta n by blending various types of liquid crystal substances. Also, for the tr speed going up, the response speed is increased by the changing of delta E or V. For the td speed going down, the isomerism of the dielectric constant at low frequency is positive and at high frequency, it is negative. High frequency is applied during the voltage OFF period, this is the example that is known.

[0005] To improve the liquid crystal response speed as described above, to be effective in the dual display of ON/OFF, the condition becomes difficult to consider the intermediate tone display. This situation is explained below by referring to the diagrams shown below.

[0006] Figure 19 shows one liquid crystal molecule 43 between the electrodes 41 and 42. The liquid crystal molecule 43 is inclined at angle $\phi$ to the X axis and inclined at $\theta$ to the Z axis. When the electric field is applied in the z axis direction on the liquid crystal molecule 43 at this state, the equation for the kinetic energy of this flowing body is:

/3

[0007]

[Equation 1]

r1.......................(3)

r1.................. ....(4)

[0008] The above equation is a non-linear differential equation and cannot be explained analytically but can be explained by numerical analysis. Also, the input voltage V applied between the electrodes is given below, with a = (Es - Ep)/Ep

[0009]

[Equation 2]

V =(DZ/Ep)...............(5)

DZ is the electric flux density.

[0010] By analyzing the equations (3) to (5), the excess response property of the liquid crystal molecule can be obtained by the input voltage change. From these equations, the time change amount of the liquid crystal molecules depends on the input voltage. The time change amount of the liquid crystal molecules obtained in this manner, $\theta$ (z, t) and $\phi$ (z, t) can be entered into the 4 x 4 matrix of Barrman. The final optical response property can be obtained.

[0011] On the other hand, figure 20 shows the permeability rate - input voltage characteristics of the liquid crystal.

From this characteristic, usually, to obtain the contrast ratio of 100/1, the input oscillation width of 5V is required for normal white but when it is at the intermediate tone level, the response speed is slower than the case of the dual display in the intermediate tone level display. The oscillation width becomes 1.5 - 2. Therefore, there is a problem when the liquid crystal is used in full color - display like in a TV.

[0012] That is, when the liquid crystal display device is used in the full color - display like a TV, the response speed at the intermediate tone level must be within 10 msec but in reality, the dual display is not possible in 20 msec. Therefore, significant remainder images are up in the dynamic image display, a high quality image cannot be obtained.

[0013]

[The problems resolved by the invention] In the conventional liquid crystal display device as described above, sufficient response speed cannot be obtained in the intermediate tone level. The problem is that high quality image cannot be obtained when using this display in the full - color display like a TV.

[0014] The purpose of the invention is to focus on the problem and offer a liquid crystal display device that can

provide a drive circuit where a high response speed can be obtained in the intermediate tone level or in the dual display.

[Constitution of the invention]

[0015]

[Means for resolving the problems] The liquid crystal display device of the invention is characterized with a memory circuit for image that is provided to hold at least one field image of the input image signal. The level fluctuation in the time axis direction is detected for each pixel from the input image signal and the image signal held in this memory circuit. The response characteristic of the liquid crystal display device is improved by providing a time axis filter circuit with a high range enhancing filter in the time axis direction of each pixel of the input image signal according to the output. In particular, the remainder image is reduced, the response speed in the intermediate tone display is increased and a high quality image is obtained.

[0016]

[Action] According to the invention, when the response speed of the liquid crystal molecule is slow, the response speed can be increased or decreased by supplying a high range component of input image signal called the increasing

up process, the response speed can be speed up or down. Therefore, the response speed of the intermediate tone level can be improved. This display is used in the full color - display like in a TV, high quality images can be obtained.

[0017]

[Implementation example] The implementation example of the invention is explained below.

[0018] Figure 1 shows the essential constitution of the 1st implementation example. The input image signal S(t) in the diagram is the signal after the video signal is broken down into R, G, B and since the same process is carried out in the R, G, B signals, only 1 channel out of all these is shown. The input image signal S(t) is held in the memory circuit for image of the image signal of at least 1 field part. The differential meter 2 consists of the input image signal S(t) and the memory circuit 1 for image. The level fluctuation detection circuit detects the fluctuation of the signal level between the 1 field when there is a difference in each pixel signal. The difference signal Sd(t) in the time axis direction obtained from this differential meter 2 and the input image signal S(t) are inputted in the time axis filter circuit 3.

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[0019] The time axis filter circuit 3 consists of a weight addition circuit 32 with the weight coefficient alpha according to the response speed in the differential signal Sd(t) and it consists of an addition device 31 for adding the input image signal S(t) and the differential signal that is weight added. This is the corresponding type of filter circuit where the filter characteristic is changed by the input level of each pixel of the input image signal and the output of the level fluctuation detection circuit. The range in input image signal S(t) is enhanced in the high range of the time axis direction by this time axis filter circuit 3 in the time axis direction. The high range enhanced signal that is obtained is supplied to the liquid crystal display part 5 converted in the alternating current signal by the pole reversal circuit 4. The liquid crystal display part 5 holds the display electrode in each intersecting part of several drive signal wires intersecting several data signal wire. This is the liquid crystal display part of the active matrix system.

[0020] According to this implementation example, figure 2 shows the signal wave form showing the form of the improved response characteristic. To explain briefly, the input image signal S(t) is changed with 1 field period. The signal level is changed rapidly at 2 fields. In this case,

the input signal change in the time axis direction, that is, the differential signal Sd(t) becomes the 1 field positive time when the input image signal becomes positive as shown in the diagram. When it is changed negatively, it becomes 1 field negative time. High range enhancing is possible by the adding this differential signal to the input signal. There is permeability fluctuation in the liquid crystal cell with the input signal change by the response speed of the liquid crystal. A weight coefficient alpha is added to correct the range so an overshoot is not generated. Thus, a signal Sc (t) is obtained with a corrected high range as shown in the figure. The optical response characteristic I (t) is improved as shown in the solid line against the example of the conventional system shown in dotted line.

[0021] Specifically, the conveyance function of the liquid crystal shown in figure 3 is HLCD (wt). The frequency characteristic Ht (wt) after the high range enhanced function Hc(wt) is given below.

Ht (wt) = HLCD (wt). Hc (wt)

Hc (wt) = alpha (1 - exp (j.2 pi wt/wc)} + 1

Wc = 2 pi/60

[0022] That is, in this implementation example, as Ht (wt) becomes in the wide band region, as the HLCD (wt) is

reduced, it is compensated by Hc(wt). To determine this property or to determine the weight coefficient alpha, the dynamic property of the liquid crystal molecule explained with the conventional technology can be explained using formula (3) to (5) using alpha as the parameter.

[0023] Figure 4 shows the essential constitution of the 2nd implementation example. Furthermore, for the implementation examples, the same symbols as figure 1 are used for the parts corresponding to those of figure 1 so an explanation is omitted. The response speed of the liquid crystal as explained in the conventional technology is different, it goes up and down. Whether the change of the input is the change in the upward direction or the change in the downward direction can be detected. In these cases, a method with different high range enhancing amount is desired. This is realized in the 2nd implementation example.

[0024] That is, in this implementation example, two weight added circuits 321 and 322 are provided. When the field space difference is positive (during the upward direction), the weight coefficient for high range enhancing is alpha1. When it is negative (during the downward direction), the weight coefficient in this case is alpha 2. The outputs of these weight added circuits 321 and 322 are switched by the

switching circuit 33 and provided to the addition device 33.

[0025] Thus, as shown in figure 5, the high range enhancing amount is added for the difference in the increasing direction and the decreasing direction, a correction signal Sc (t) is obtained. The optical response property I (t) can be increased more.

[0026] Figure 6 shows the essential constitution of the 3rd implementation example. The different point in Figure 6(a) from the 2nd implementation example is the change in the high range enhancing amount which is the control parameter, there is no change in the input. It also consists of that input level. The response speed of the liquid crystal does not change the input voltage. It depends on the initial value of the voltage or the voltage after the change, better corrected high range compensation can be performed.

[0027] Figure 6(b) is a more generalized implementation example than figure 6(a). The weight coefficient alpha of the weight added circuit 32 is changed by the input level and the field space difference in the input. In addition, in the implementation example shown in figure 6(c), the frequency of the part where the high range goes up is extracted by the band pass filter BPF (or by the high pass filter HPF) 1′ of a higher order. The weight coefficient

alpha of the weight added circuit 32 is controlled by that output and input levels. According to this implementation example, the response property of the liquid crystal is compensated. A high range enhancing filter can be obtained.

[0028] Figure 7 shows the essential constitution of the 4th implementation example. The conventional technology is not explained but the response speed is inversely proportional to square $d^2$ of the cell gap. Therefore, as the cell gap d is reduced, the response speed is increased. Therefore, to increase the contrast, the Morgan condition must be satisfied, Delta nd/lambda (Delta n: the isomerism of the refractive index, lambda: the input wavelength). Therefore, to obtain an optimum contrast, the cell gap must be changed by R, G, B. This is called the multigap. Problems are generated since the response speed is different due to the R, G, B. Therefore, in this example, the respective high range enhancing amount is controlled suitably with the R, G, B corresponding to the multigaps. Here, the 3 basic circuits of figure 6 b) are used. It is preferred that 3 basic circuits are used for other implementation examples.

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[0029] Figure 8 shows the essential constitution of the 5th implementation example. In this implementation example, a

temperature detector 6 is provided for detecting the liquid crystal temperature of the liquid crystal display part 5. This is added to the circuit of the implementation example of figure 6(b). The weight added circuit 32 is controlled by the output of this temperature detector 6.

[0030] As shown in figure 9, the response property of the liquid crystal depend strongly on the temperature. When there is a difference in the decreasing and increasing response property, these depend on the temperature. When it goes up, this affects greatly the temperature reliance of the viscosity n. When it goes down, the temperature reliance of the viscosity n is pacified by the temperature characteristic in the mother elastic constant K. Therefore, according to this implementation example, the weight constant alpha which is the high range enhancing parameter can be changed and controlled according to that output where the liquid temperature is detected. Optimum compensation can be performed for the response property.

[0031] Figure 10 shows the temperature reliance on the physical constant of the liquid crystal. The physical constant of the liquid crystal shown in the diagram is changed by the temperature. Therefore, the temperature can be detected by detecting the change in this physical constant. The temperature detection is performed using the

liquid crystal inside the same panel, suitable temperature compensation can be performed in that panel.

[0032] Figure 11 is the constitution example of the liquid crystal temperature detector using such liquid crystal. As shown in figure 10, the dielectric constant E of the crystal is changed by the temperature. Therefore, the change in the dielectric constant and the change in the liquid crystal capacity CLCD are converted to voltage by the capacity CD and outputted. The temperature detection theory of figure 11 is shown below. Next, the relationship of the input and output of figure 11 is shown as:

$$Vout = Vin \cdot CLCD / (CD + CLCD)$$

The change of the liquid crystal capacity CLCD can be detected as the change in the output Vout.

[0033] An example of the liquid crystal temperature detection method is a method where the change is according to the temperature of the Vth value of the liquid crystal using the optical detector. The going up and going down time is calculated for every fixed time using a microprocessor. It is a method that is carried out with a feed back to control the overshoot.

[0034] Figure 12 show the essential constitution parts of the $6^{th}$ implementation example. In this implementation example, a moving detection circuit 8 is provided to detect

the moving of the input image signal. The weight added amount between the inside of the field and the outside of the field is determined according to the moving amount detected by this moving detection circuit 8 and it is converted into an interlaced signal (sequence scanning signal) by the time axis compression in the sequence scanning conversion circuit 7. Since this sequence scanning converted signal becomes the drive signal, this signal is changed at each signal switching period of 1 pixel in 1 field period. This becomes an important parameter for determining the response speed of the liquid crystal.

[0035] The weight coefficient alpha is provided and changed according to the moving amount and the input level in the change amount inside the 1 field period obtained by the differential meter 2 and the memory circuit 1. The sequence scanning conversion signal is corrected by the time axis enhancing filter which consists of a weight added circuit 32 and an addition circuit 31.

[0036] Figure 13 is a typical constitution example of the moving detection circuit 8. The movement of the bright signal is detected by the differential meter 13 for the difference in the input and output of the frame memory 11. It is detected as the 1 frame difference part by LPF14. The moving of the color signal is detected by the differential

meter 16 for the difference in the input and output in the serial circuit of the frame delay circuit 12 and the frame memory 11. It is detected as the 2 frame difference part by the BPF17. These differential signals are detected by the maximum value detection circuit 19 via the respective absolute value detection circuits 15 and 18. The output of this maximum value detection circuit 19 is outputted as the moving signal via the extension circuit 20 and the decoder 21. The extension circuit 20 is provided for the time space filter using the moving information in the 2 fields so the detection does not leak when it is moving rapidly.

[0037] The movement of the image is detected by such a constitution but there is error detection. For example, when the static image noise is detected as a moving image, that noise is compensated alpha times as shown in the constitution of figure 12.

[0038] To compensate this error detection, a weight coefficient alpha Table is provided as shown in figure 14(a)(b). As shown in figure 14 (a), when the moving amount is small, the noise is evaluated and it is not in the high range enhancement. In actual fact, when the moving amount is used as the field space difference. The Table of the dotted line of figure 14(a) and the Table of the solid

line are compared. The results verified that the Table with the solid line show that the noise is reduced greatly.

[0039] For the case of the Table shown in figure 14(a), non-continuous points are possible due to the image. Therefore, the Table shown in figure 4(b) is close to the theoretical line.

[0040] Figure 15 is the implementation example showing the change and control of the weight coefficient alpha which is the high range enhancing parameter according to that output. The liquid crystal temperature detection is carried out similar to the implementation example of figure 8.

[0041] When there is temperature non-uniformity due to a spot in the liquid crystal display part, the most optimum temperature control cannot be performed in the one point temperature detection. In this case, the temperature detection at several locations in the liquid crystal display part can be performed effectively.

[0042] Figure 16 is the implementation example consisting of the improvement for figure 15 with the above constitution. The liquid crystal display part 5 is divided into 4 in this implementation example. The temperature at the 4 corners of each small image is switched by switch 22 and this is detected. This switch 22 is controlled by the image position detection circuit 23. Similarly, the

temperature detected at several locations in this manner is used as the control data for the weight coefficient alpha. The same implementation is carried out for the implementation example of figure 15.

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[0043] Furthermore, the temperature data of the 4 corner of the liquid crystal display part is not used. For example, the temperature mirror pattern is used as the standard as shown in figure 17. The temperature of the end Xe becomes CT0. The temperature of the distance x1 is CT1, this is effective with the measurement obtained.

[0044] In addition to the implementation example shown in figure 12, figure 18 is an implementation example provided with a complex noise removal filter 24, this is provided at the image signal input part. As previously explained, when there is complex noise in the input signal, the complex noise is amplified by the error detection. This error detection can be reduced by providing with a complex noise removal filter 24 according to this implementation example. When this complex noise removal works effectively, the motion detection circuit 8 is omitted. As previously explained, it is effective to provide a complex noise removal filter at the input terminal part similar to the implementation examples of figures 1, 4 and 8.

[0045]

[Effect of invention] According to the invention as explained in detail above, by high range enhancing the input image signal using the time axis filter, the response characteristic of the liquid crystal display device can be improved. In particular, the response speed at the intermediate tone display is increased, the remainder image is reduced and a high quality liquid crystal TV can be realized.

[Brief explanation of the diagrams]

[Figure 1] This is the diagram showing the essential constitution of the 1st implementation example of the invention.

[Figure 2] This is the signal wave form diagram for explaining the action of the same implementation example.

[Figure 3] This is the diagram showing the characteristic of the high range enhancing filter of the same implementation example.

[Figure 4] This is the diagram showing the essential constitution of the 2nd implementation example.

[Figure 5] This is the signal wave form diagram for explaining the action of the same implementation example.

[Figure 6] This is the diagram showing the essential constitution of the 3rd implementation example of the invention.

[Figure 7] This is the diagram showing the essential constitution of the 4th implementation example of the invention.

[Figure 8] This is the diagram showing the essential constitution of the 5th implementation example of the invention.

[Figure 9] This is the diagram showing the temperature dependence of the response speed of the liquid crystal.

[Figure 10] This is the diagram showing the temperature dependence of the physical constant of the liquid crystal.

[Figure 11] This is the diagram showing the constitution example of the temperature detector of the liquid crystal.

[Figure 12] This is the diagram showing the essential constitution of the implementation example provided with the moving detection circuit.

[Figure 13] This is the diagram showing the constitution example of the moving detection circuit of the same detection circuit.

[Figure 14] This is the diagram showing the relationship of the moving amount and the high range enhancing amount.

[Figure 15] This is the diagram showing the essential constitution of the implementation example provided with a temperature detector in the implementation example of figure 12.

[Figure 16] This is the diagram showing the implementation example as the temperature detection is performed at several locations, different from figure 15.

[Figure 17] This diagram shows the standard temperature distribution for temperature control.

[Figure 18] This is the diagram showing the essential constitution of the implementation example provided with the complex noise removal filter.

[Figure 19] This is the diagram for explaining the response speed of the liquid crystal.

[Figure 20] This is the diagram showing the input voltage dependence of the permeability of the liquid crystals.

[Description of the symbols]

1 - memory circuit for image

2 - differential device (level change detection circuit)

3 - time axis filter circuit

31 - addition device

32 - weight addition circuit

33 - switching circuit

4 - pole reversal circuit

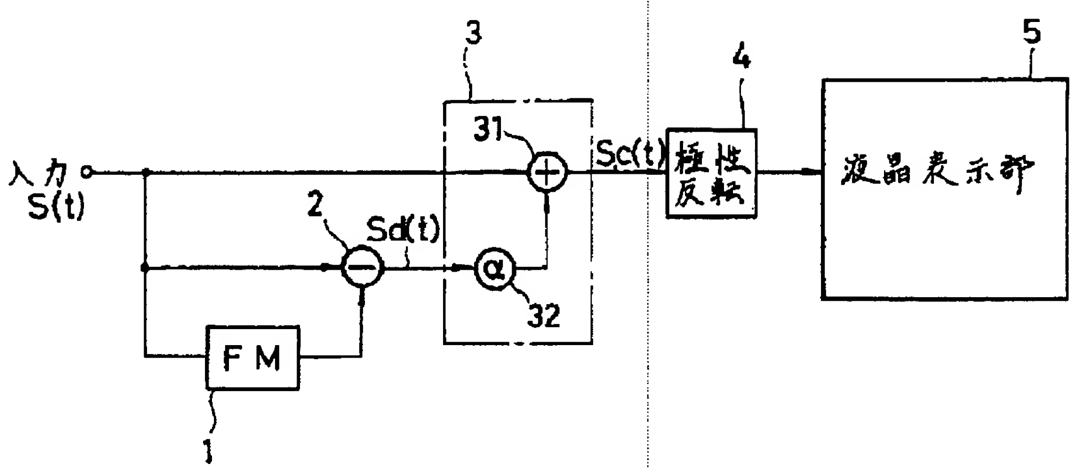
5 - liquid crystal display part

6 - temperature detector

7 - sequence scanning conversion circuit

8 - moving detection circuit

【図1】

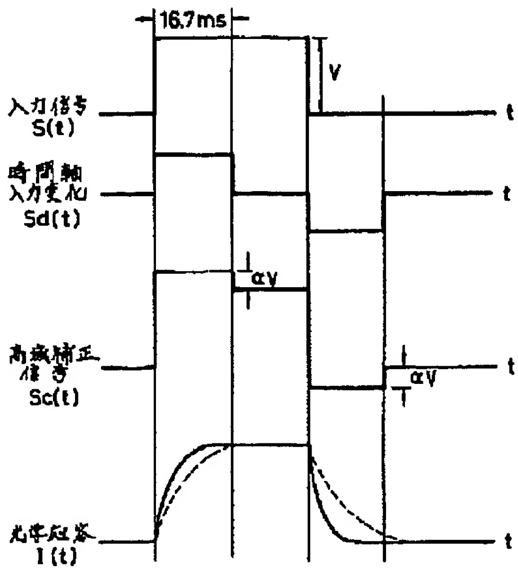



Input S(t)

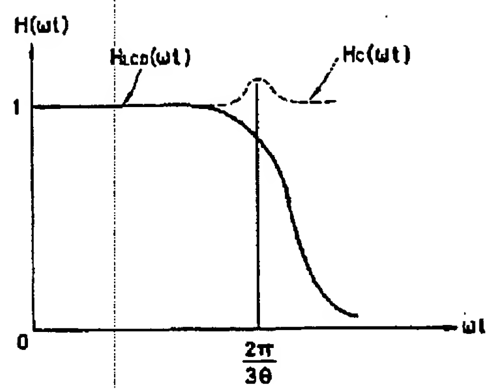
4 - pole reversal

5 - liquid crystal display part

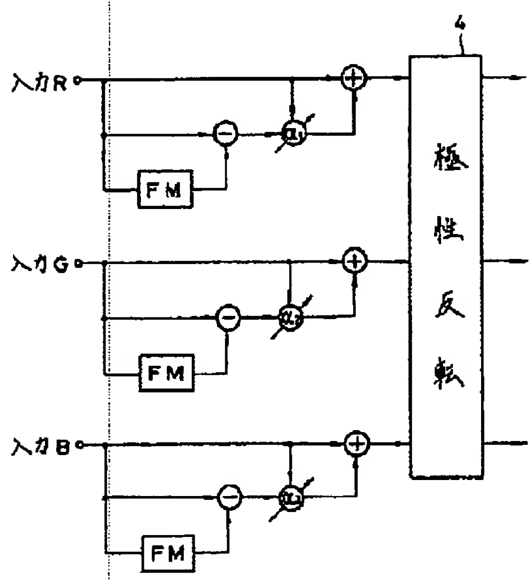
【図2】



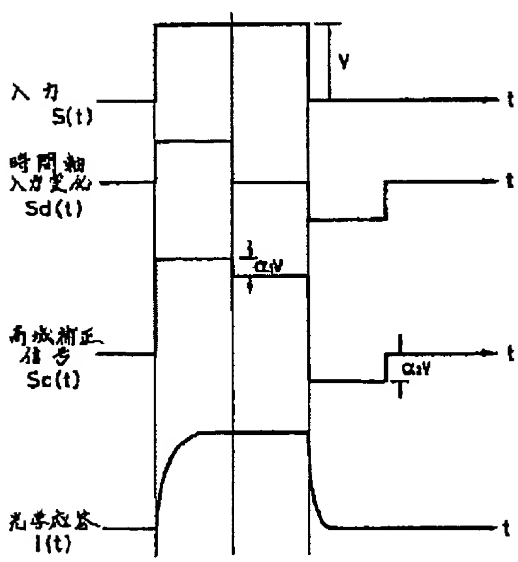

【図3】



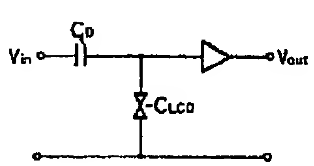

【図7】



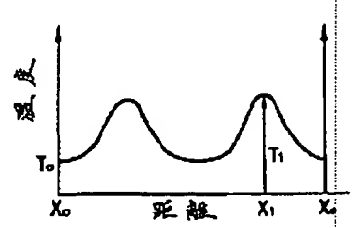

【図5】




【図11】




【図17】



[Figure 2]

Input signal S(t)

Time axis input change Sd(t)

High range correction signal Sc(t)

Optical response I(t)

[Figure 3]

[Figure 5]

Input signal S(t)

Time axis input change Sd(t)

High range correction signal Sc(t)

Optical response

[Figure 7]

Input R

Input G

Input B

4- pole reversal

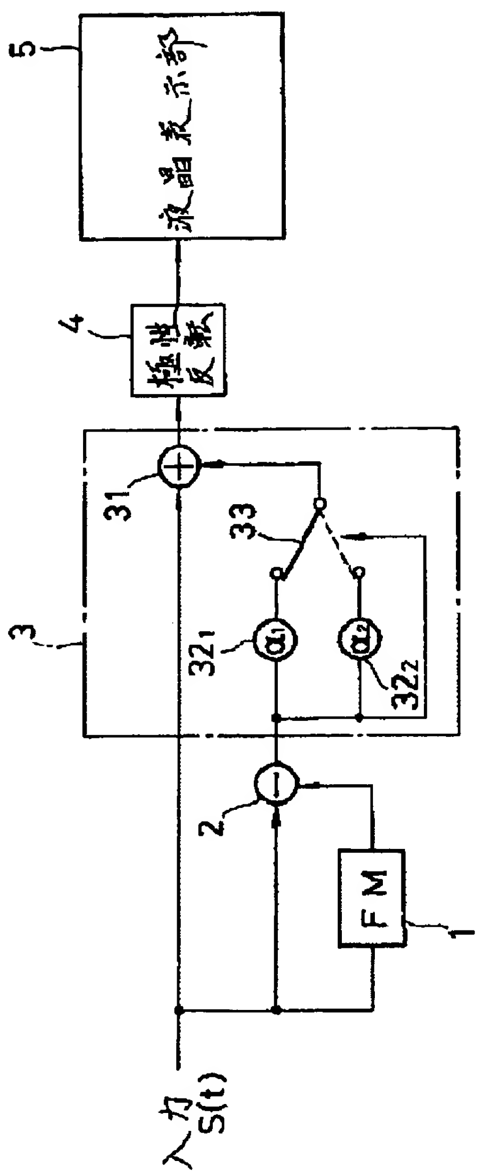
[Figure 11]

[Figure 17]

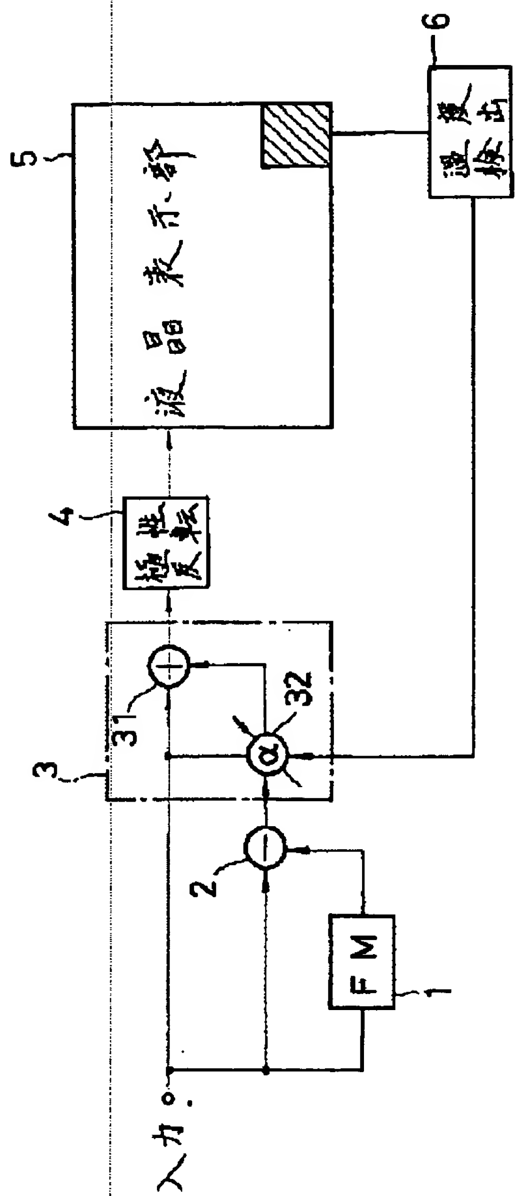
Temperature T0

Distance X0 - Xe

【図4】




【図8】




[Figure 4]

Input S(t)

4 - pole reversal

5 - liquid crystal display part

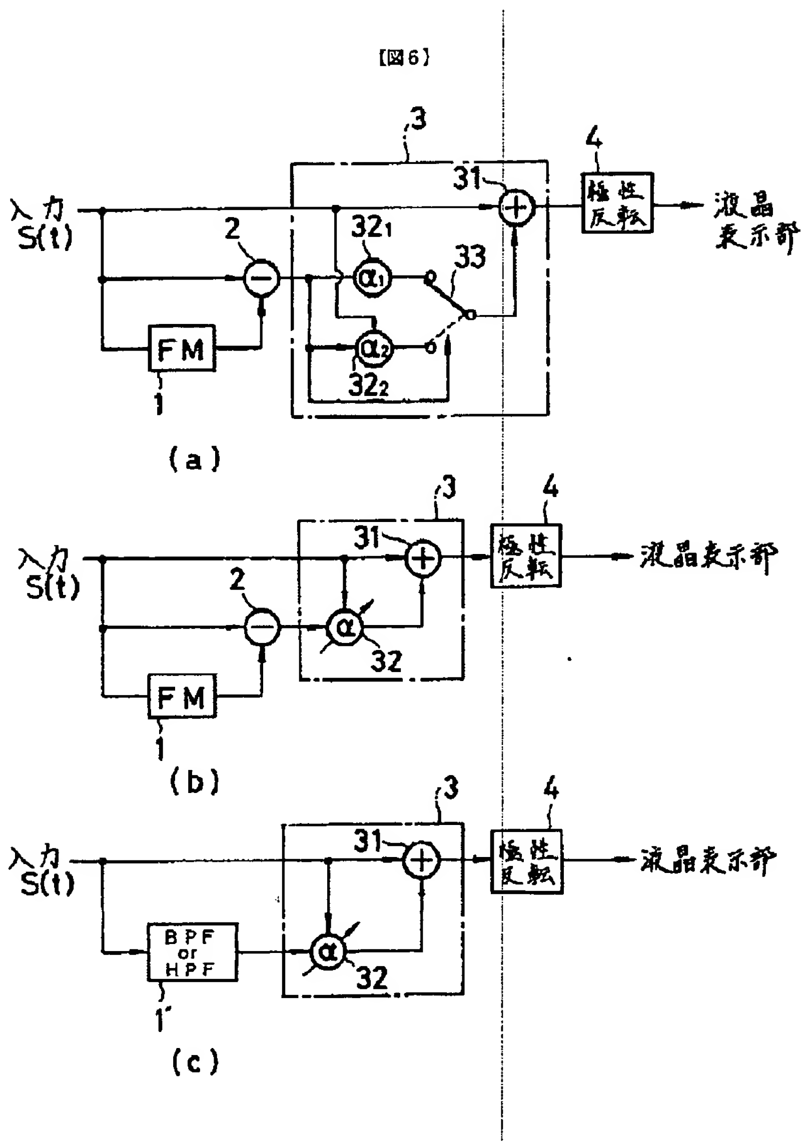
[Figure 8]

Input

4 - pole reversal

5 - liquid crystal display part

6 - temperature detection




[Figure 6]

(a) Input S(t)

4 - pole reversal

Liquid crystal display part

(b) Input S(t)

4 - pole reversal

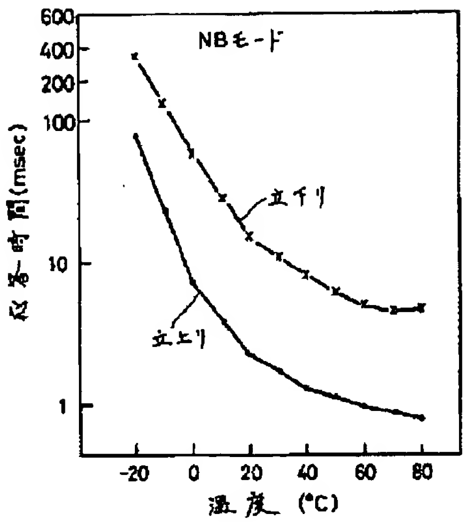
Liquid crystal display part

(c) Input S(t)

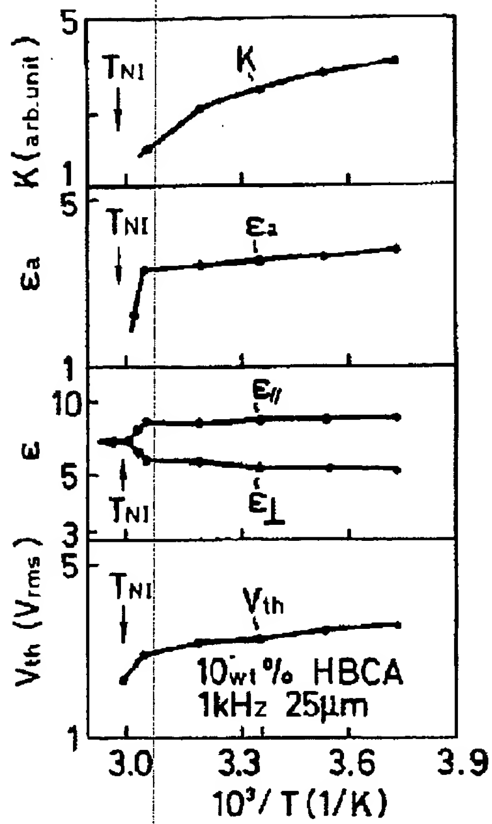
4 - pole reversal

Liquid crystal display part

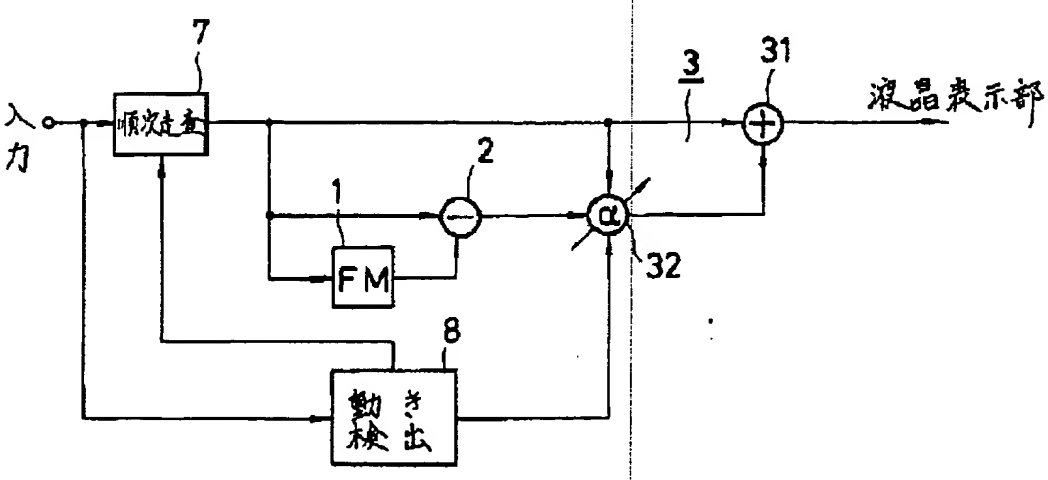
【図９】


NBモード
応答時間(msec)
600
400
200
100
10
1
立下り
立上り
-20
0
20
40
60
80
温度 (°C)

【図１０】


K (arb.unit)
TNI
K
εa
εa
ε
ε//
ε⊥
Vth (Vrms)
Vth
10wt% HBCA
1kHz 25μm
3.0
3.3
3.6
3.9
10³/T (1/K)

【図１２】


入力
順次走査
7
1
FM
2
3
31
α
32
8
動き検出
液晶表示部

[Figure 9]

Response time (msec)

Temperature (degree C)

NB mode

x-x downward direction curve

.-. upward direction curve

[Figure 10]

[Figure 12]

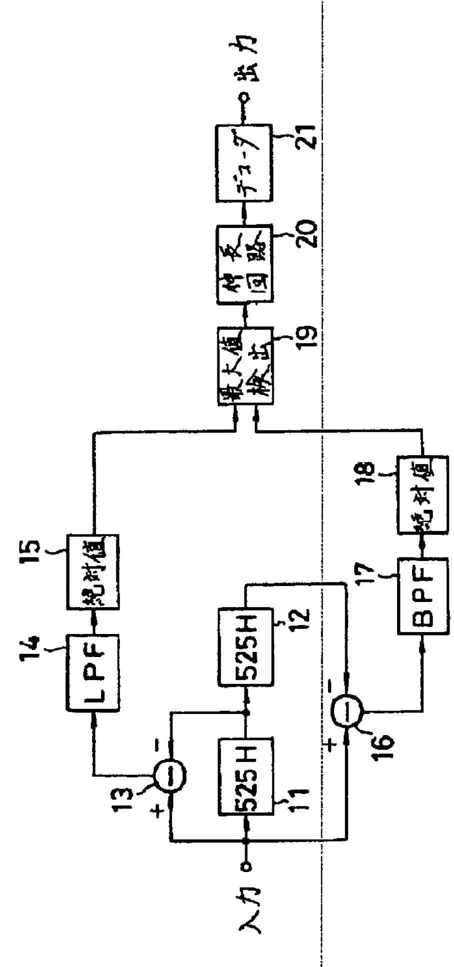
Input

7 - sequence scanning

8 - moving detection

Liquid crystal display part

[図13]




[Figure 13]

Input

15 - absolute value

18 - absolute value

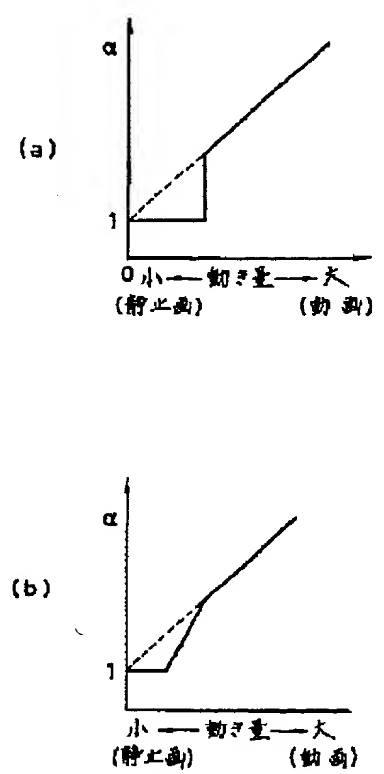
19 - maximum value detection

20 - extension circuit

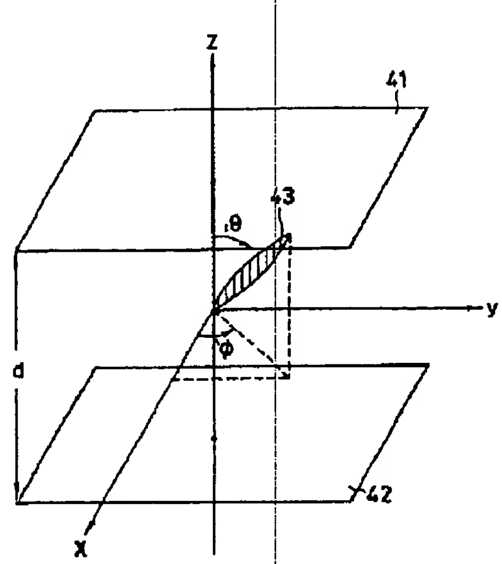
21 - decoder

Output

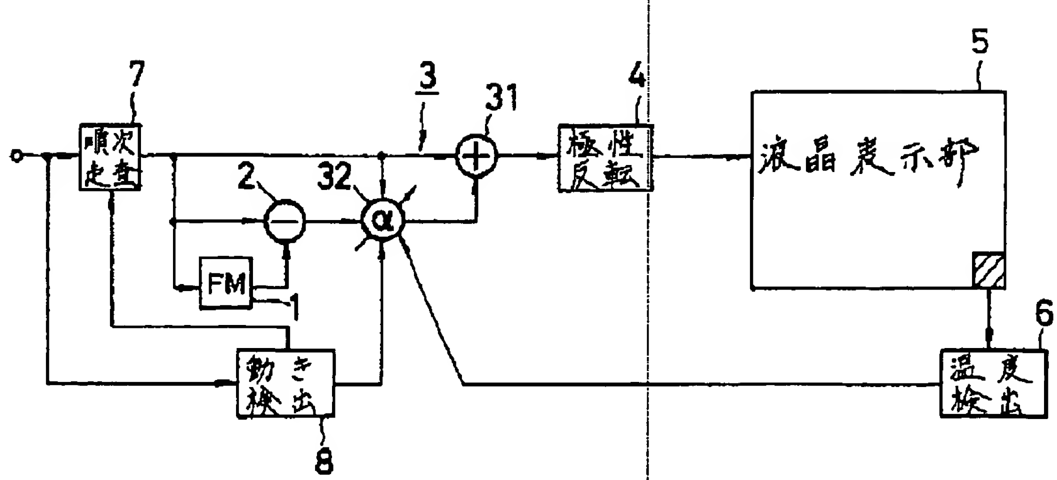
【図14】


α
1
0 小——動き量——大
(静止画)
(動画)
α
1
小——動き量——大
(静止画)
(動画)

【図19】


z
41
θ
43
y
φ
d
42
x

【図15】


7
3
31
4
5
順次走査
2
32
極性反転
液晶表示部
FM
1
6
動き検出
温度検出
8

[Figure 14]

(a) Small -> moving amount -> large

(static image) (dynamic image)

(b) small -> moving amount -> large

(static image) (dynamic image)

[Figure 19]

[Figure 15]

7 - sequence scanning

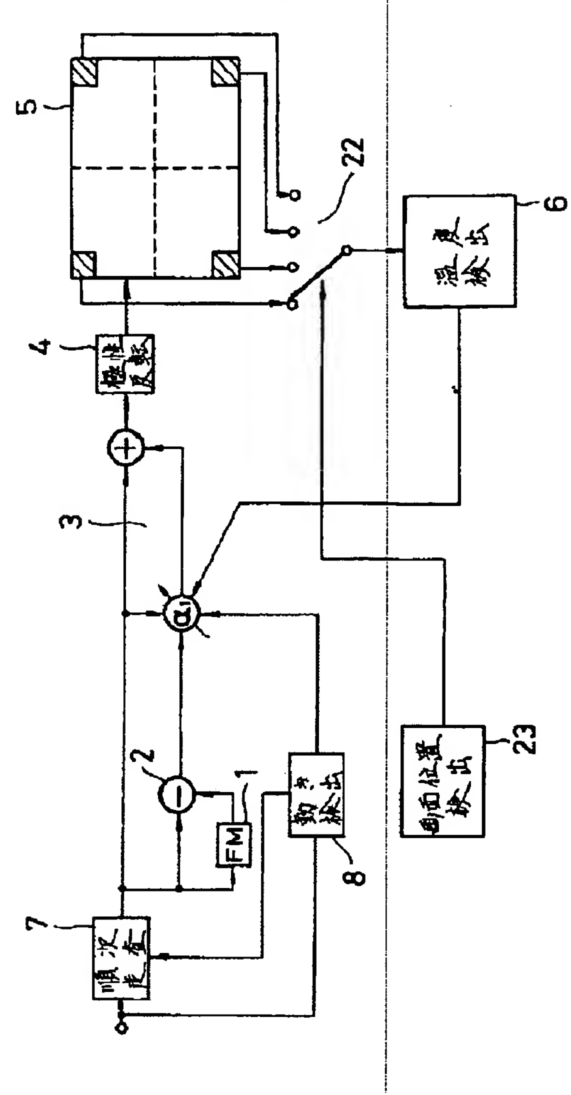
8 - moving detection

4 - pole reversal

5 - liquid crystal display part

6 - temperature detection

【図16】




[Figure 16]

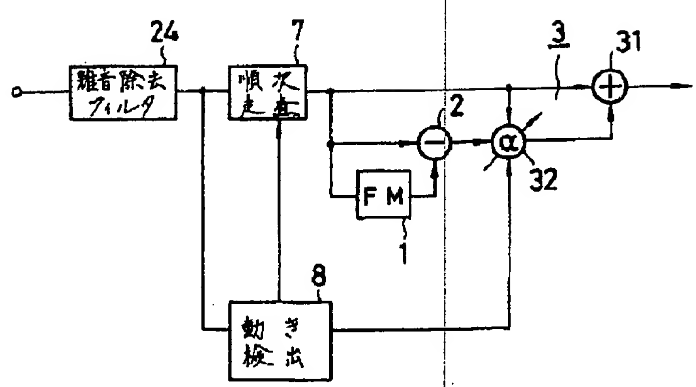
7 - sequence scanning

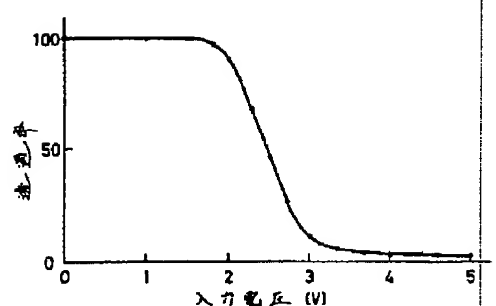
8 - moving detection

4 - pole reversal

23 - image position detection

6 - temperature detection




[Figure 18]

24 - complex noise removal filter

7 - sequence scanning

8 - moving detection

[Figure 20]

Permeability rate (0 - 100)

Input voltage (V)